ADJUSTING DEVICE AND ADJUSTABLE SUPPORT DEVICE FOR BEDS, MATTRESSES, ARMCHAIRS AND THE LIKE

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The invention pertains to an adjusting device for beds, mattresses, armchairs and the like, consisting of support elements or bar members extending at an angle to the adjusting direction and at least one drive device for modifying the inclination of the support plane, in which at least one pivotable raising lever is provided, or in which the bar members form a link chain. It additionally pertains to an adjustable support device for mattresses or cushions, beds, armchairs and the like consisting of pivotable bars with support elements extending between the bars, spanning a support plane.

Such adjusting devices are known, for instance, for holding mattresses of beds. A frame, or at least lateral bars, carries the support elements, which span the support plane of the mattress or the like. In addition to cloth supports, metal grids and the like, spring strips that form a so-called slat grating are especially often used. The adjusting device is intended to provide comfort and relaxation in the supine, seated or semi-supine position.

Using a motor-driven or manually pivotable raising lever is known, for instance, for modifying the inclination of hospital beds. As a rule, these levers are rigid. Most of these raising levers have the disadvantage that they are visible in the sitting or semi-supine position and are therefore visually disruptive. Safety risks also exist. Moreover, it is only possible with [these levers] to pivot two areas (head part and foot part), each straight within itself, about a center part. Whereas it is not possible to influence the shape of the lateral bars defining the support plane, i.e., to adapt them more to the back and posterior of a human being.

As an alternative solution, it has therefore been proposed to design the lateral bars as a link chain and pivot the links relative to one another. Such pivoting takes place by means of pressure or preferably by means of tension belts or pull rods. Such an adjusting device is extraordinarily complex, however, and consists of very many individual parts if one would like to achieve a semi-supine or sitting position starting from the extended supine position. This becomes particularly clear from WO 01/26509 A1. Such adjusting devices do indeed permit a very elegant external appearance of the finished product, because supporting, adjusting and drive elements are completely integrated into the bars or into a mattress or upholstery. However, in addition to the complex construction, it is disadvantageous in that the successive or simultaneous relative pivoting of various bar members can only be controlled relatively imprecisely. But it is desirable for the adjusting device to be able to assure an optimal support of the back, the posterior and, optionally, the legs in the various positions between the extended resting or supine position and the very upright sitting position, i.e., above all, to support the spinal column.

With this background, the problem underlying the invention is to implement a adjusting device of particularly simple construction. An additional objective of the invention is to design the mechanical structure of such an adjusting device robustly and nevertheless to permit an ergonomic multi-element adjustment. An additional objective of the invention is to design the adjusting device robustly and yet elegantly, i.e., without externally projecting or protruding head part or back rests. Increased safety is also desirable. Finally, one objective is to specify exactly and decisively the mutual displacement of bar members in every general inclination between a supine and a sitting position of the user.

According to the invention, an adjusting device is proposed with the characteristics of Claim 1 or 2, as well as an adjustable support device with the characteristics of Claim 3. The core of the invention is thus a combination of at least one pivotable raising lever and several bar members pivotable relative to one another, so that the general raising movement and the ergonomic detailed movement are combined. Such an adjusting device leads to a robust, very simply constructed, visually appealing and specifically ergonomic overall solution, as can be deduced effortlessly from the embodiment described below.

Starting from the concept of a rigid bar plus pivotable raising lever long available on the market, the bar is subdivided according to Claim 1 into several bar members, the individual bar members being separated from the pivotable raising lever and pivotable to different extents in relation to one another. According to Claim 2 and starting from adjusting devices for beds, mattresses, armchairs and the like as known from WO 01/26509 A1 which comprise two parallel link chains as bars, the bar members jointly house (essentially completely) an inherently rigid pivotable raising lever serving for relative adjustment of the bars. According to Claim 3, the bars for adjustable support devices for mattresses, or cushions of beds, armchairs and the like with pivotable bars consist of inherently rigid pivotable raising levers; the latter carry a link chain of mutually pivotable slat-bearing members, the raising lever, on which a fine structure in the form of a chain with relatively pivotable links is superimposed, being the dominant part of the pivoting bar in this solution.

Since the forces weighing on the free foot end in case of a raised foot part are considerable, a foot part brace usually serves to intercept and direct these forces to a fixed substructure such as a bed frame. Such foot braces are generally simple connecting rods, pivotably seated at one end on the slat grating and on the support component, such as the bed frame, at the other. This arrangement for hospital beds, for example, makes the implementation of an elegant and inconspicuous design difficult and makes an exact match necessary between, for instance, the slat grating and a bed frame. It also hinders manually pivoting the foot part, which is unfavorable for practical use. In order to create a simple and inconspicuous foot support for devices of this class that is uncomplicated to handle, an adjusting device is proposed with the

characteristics of Claim 17, which is also of inventive significance on its own, independently of the characteristics of Claims 1-3. Accordingly, at least one of the bar members comprises a driven extensible brace element for bracing the bar member on a base surface. The driving of the extensible brace element is preferably performed simultaneously by the adjustment drive of the bar members, preferably by means of a raising lever driven to undergo a pivoting motion. A rocker bar integrated into the bar member in question represents a particularly simple drive transfer means for extending and retracting the brace element.

In order to be able to utilize electric drive motors of the drive unit of adjusting devices of this class more effectively while housing them inconspicuously, a pairwise mounting of two drive motors in each of two bar members, particularly stationary ones, of the adjusting device is proposed according to the characteristics of Claim 23. This has the effect, among other things, that the head or foot part of the adjusting device is synchronously raised or lowered on both bar sides, without torsion-induced twisting arising between the bar members of the head part and/or the foot part. Thus it is possible to make do with compact drive motors and simple gear assemblies, even for relatively wide beds, mattresses, armchairs and the like, and to dispense with expensive anti-torsion devices. Such an adjusting device is of inventive significance on its own, even independently of the adjusting devices according to Claims 1-3 and 17.

The above-mentioned components to be used according to the invention, as well as those claimed and described in the examples of embodiments, are not subject to any special exceptional conditions in terms of size, shaping, material selection and technical conception, so that the selection criteria known in the field of application can be applied without restriction.

Additional details, characteristics and advantages of the invention result from the subordinate claims as well as from the description below of the associated drawings in which, for the sake of example, several embodiments of the adjusting device according to the invention are illustrated. Shown in the drawings are:

Figure 1A, an adjustable slat grating for bed mattresses in raised position, in perspective;

Figure 1B, the same adjustable slat grating in a flat position, in perspective;

Figure 2, from the same slat grating, the head area of one bar [sic; one bar of the head area] in an exploded view, in perspective;

Figure 3A, a simplified representation/embodiment of the bar according to Figure 2 in a side view of the inside part of the bar, in the extended position;

Figure 3B, the same inside part of the bar in slightly raised position;

Figure 3C, the same inside part of the bar in markedly raised position;

Figure 3D, the same inside part of the bar in almost completely erect position;

Figure 4A, a perspectival exploded view (corresponding to Figure 2) of the bars of Figures 3A-3D;

Figure 4B, the same bar in the assembled state, partially cut away;

Figures 5A-5D, the foot area of the bar part according to Figures 3A-4B in a sequence of different raising stages;

Figure 6A, a side view of an alternative embodiment of an adjustable slat grating for bed mattresses, into the interior of the bar members forming the foot part, specifically, in the extended rest position of the adjustable slat grating;

Figures 6B-6E, a sequence of the same detail in various adjustment positions of the slat grating;

Figure 7A, an additional alternative embodiment of an adjusting device for bed mattresses, armchairs and the like in a plan view in the non-adjusted rest state;

Figure 7B, a détail enlargement of the same adjustment device in the area of the motor receptacle on one long side;

Figure 8A, a joined adjusting lever pair for the head part of the same adjusting device as in Figures 7A/B in a perspective representation; and

Figure 8B, a joined adjusting lever pair for the foot part of the same adjusting device as in Figures 7A/B in a perspective representation.

Figures 1A and 1B show a slat grating for bed mattresses on which the invention is implemented. A rigid bed frame 30 consists of parallel long beams 30A and parallel cross beams 30B made, for instance, of wood. An adjustable slat grating 30 is accommodated between long beams 30A, a multiply pivotable head part 32A and a multiply pivotable foot part 32B being articulated on the appropriate sides to a middle part 32C. Middle part 32C is joined to long beams 32A [sic; 30A] of rigid bed frame 30 permanently by means of, for example, screws. Slat grating 32 is composed in essence of two articulated bars 16 on the parallel long edges, and spring strips or bows 34 connecting the bars 16. In the illustrated and, in that sense, preferred embodiment, the two bars 16 are composed of a total of seven bar members 16A-16G, which are pivotably joined together, as will be seen from the description below.

Figure 2 shows the head area of a bar 16. From the illustration, it is evident that the bar 16, i.e., each link in the bar, is divided longitudinally in the vertical plane and holds, in the manner of a casing, an inherently rigid raising lever 14 of length roughly equal to the head area of the bar and almost completely encloses it between inside bar part 16′ and outside bar part 16″. The casing-like bar 16, or the casing-like bar members 16A-16D comprise as integral components adjusting members 18A, which, during the pivoting up or lowering of head part 32A by pivoting raising lever 14′ [sic; 14], make it possible to pivot the individual bar members relative to one another and in the same or in a different rotational sense with respect to one another. This and other special features of the adjusting device according to the invention will be explained further on the basis of the second embodiment with Figures 3A-5D.

As can be deduced from the sequence of Figures 3A-3D in conjunction with the perspectival representations of Figures 4A and 4B, raising lever 14 for head part 32A of slat grating 32 can be pivoted about the axis of a torsion tube 14A. For the pivot drive in the illustrated and, in that sense, preferred embodiment, a quarter-circular tooth segment 14B is provided, at the raising lever end of which one end of a link chain is engaged by way of a bore 14C. The other end of the link chain, not shown in the drawing, but known from German Patent Application No. 102 31 290.7, is pulled by a drive motor that extends in bar member 16E in the area of central part 32C. If desired, torsion tube 14A can be seated at its end areas in corresponding bearings or bores of long beams 30A of rigid bed frame 30 and/or bar member 16E. Tooth segment 14B can fulfill the function of a gusset plate. Rigid raising lever 14 preferably consists of metal or some other comparably inflexible material. As shown in the drawings and, in that sense, preferred, it carries adjusting members 18B in the form of laterally projecting pins which, as will be explained later, have the function of sliding blocks or pads. Raising lever 14 is also distinguished by at least one angled section 14D, so that its profile is not necessarily straight. Preferably, said at least one angled section 14D is oriented in the direction of the general displacement A. This allows, as will be explained, a more-than-proportional upward pivot, especially in the highest head area, without sacrificing the fully integrated position of raising lever 14 inside casing- or box-like bar 16.

With regard to the bar, the adjusting members 18A integrated therein exist as sliding links inside each of the bar parts (inside bar part 16′ and outside bar part 16″). The sliding links of the inside and outside bar parts 16′ and 16″ are constructed and arranged mirror-symmetrically and extend on each side of the vertical longitudinal mold joint of bar 16, such that they each slidingly accommodate one of the pins of a respective pair of pins of the adjusting members 18B of the raising lever.

The mode of function of the adjusting device can be deduced in detail in connection with Figures 3A-3D described below. From these figures, it is apparent that the sole point of rotation of the raising lever 14, which coincides with the axis of the optional torsion tube 14A, as mentioned above, lies roughly in the lower quarter of box- or casing-like bar 16 at the terminal area of bar member 16E (at the left in the drawing), which defines the rigid center part 32C of slat grating 32. By contrast, pivot joints 22 for pivoting adjacent bar members 16A-16E relative to one another lie essentially at a single height near the upper plane of the bar. This is illustrated particularly clearly in the extended position shown in Figure 3A. If raising lever 14 is now pivoted up from its horizontal position shown in Figure 3A into one of the pivot positions shown in Figures 3B-3D, a relative longitudinal displacement between the bar members and the raising lever then takes place. By virtue of the fact that a forced guidance is provided between adjusting members 18B of the raising lever and the adjusting members 18A on the bar, the bar members

must also pass through transverse displacement with respect to the raising lever in this relative longitudinal displacement if, as shown in the drawings and thus preferred, adjusting members 18A on the bar are designed as sliding links and exhibit an inclination of their curves relative to the longitudinal extent of the individual bar member. Such inclinations are implemented in this embodiment, even with varying inclination profiles along the link. These inclination profiles are adapted to the desired motion or inclination pattern. As is evident from Figure 3B, uppermost bar member 16A can at first execute only a relative pivot with respect to the other bar members during pivoting upwards of raising lever 14. This is amplified by the degree of inclination of adjusting members 18A on bar members 16B and 16C. This slightly increasing upward inclination from one bar member to the next has the effect that raising lever 14 is positioned at a slight angle inside bar members 16B and 16C in comparison to the rest position (Figure 3A).

In case of further upward pivoting of raising lever 14 into the position shown in Figure 3C, however, a relative pivoting between adjacent bar members 16B and 16C increasingly occurs. This takes place in a rotational sense opposed to the upward-directed adjustment direction A of raising lever 14 in order to create a so-called lumbar support. The contrary pivot motion just mentioned is achieved by correspondingly varying inclination profiles of the various adjusting members 18A. This becomes particularly clear in a comparison of Figures 3C and 3D.

As is evident from the sequence of Figures 13A-13D, pivotable raising lever 14 is furnished with bar members that are separately pivotable, differently from the pivoting motion of the raising lever. It is also evident that the bar members jointly house, substantially completely, an inherently rigid raising lever that serves the mutual adjustment of the bar members. Finally, it is also evident that the bearing or support loads of the pivotable bar are completely absorbed by the inherently rigid raising lever, the raising lever bearing a link chain of members, pivotable relative to one another, that carry bows or spring strips.

Figures 3A-4B also reveal that at least one of the pivotable bar members comprises at least one longitudinal and transverse guide, and in this regard a sliding link is preferably active between the bar members and the pivotable raising lever. Finally, it is evident that jamming protection means 26 are provided between adjacent pivotable bar members. These jamming protection means are preferably located on the bar side opposite pivot joints 22. They can be constructed, for example, as gap-sealing circular segments, as is evident from the detail enlargement in Figure 3D. Simple assembly of the spring strips/bows 34, or of their receptacle heads, can be achieved by receptacle cutouts 28. These are preferably cut into the upper casing wall of the bar members, preferably as a slot open on one side in the outside and/or inside bar part, as is evident from Figures 4A/4B.

Finally, the sequence according to Figures 5A-5D shows another embodiment of preferably casing-like bar members 16F and 16G, which by way of one-piece integrated

adjusting members 18A provide longitudinal displaceability with respect to a raising lever 14′ and receive the latter's adjusting members 18B slidingly in the form of a pair of sliding blocks. For simplification, a foot brace 20 pivotably mounted on long beam 30A can absorb part of the lever load on the long end of the lever, with a cutout 20A [sic; 20E] receiving and/or bridging the fulcrum on the long beam in the rest position [as in] Figure 5D.

Figures 6A-6E show the foot area of an alternative bar 16. Since every individual bar member is longitudinally divided in a vertical plane and is composed in the manner of a casing of inside bar part 16′ visible in the drawing and a corresponding outer bar part, Figures 6A-6E allow a side view of inside bar part 16′. Also visible is a rigid raising lever 14′, which bar 16 receives and almost completely encloses between inside bar part 16′ and outside bar part 16″.

As can be deduced from the sequence of Figures 6A-6E, raising lever 14′ for the foot part 32B of slat grating 32 is pivotable about the axis of a torsion tube 14A. A quarter-circular tooth segment, not shown, with which a link chain engages, is provided for the pivot drive. The other end of the link chain known from German Patent Application No. 102 31 290.7 is pulled by a drive motor which extends in bar element 16E in the area of center part 32C. If desired, torsion tube 14A can be seated at its end areas in corresponding bearings or bores of long beams 30A of rigid bed frame 30 and/or bar member 16E. Tooth segment 14B can fulfill the function of a gusset plate. Rigid raising lever 14′ preferably consists of metal or some other comparably inflexible material. As shown in the drawings and, in that sense, preferred, it carries adjusting members 18B in the form of laterally projecting pins that, as will be explained below, function as sliding blocks or pads. Raising lever 14′ is also distinguished by at least one angled section 14D′, so that its profile is not necessarily straight. Preferably, said at least one angled section 14D′ is oriented in the direction of the general displacement A. Alongside an overload protection for the knee joint zone of bar 16, it offers, as will be further explained below, a driving function for the extension of the bracing element according to the present invention that is of inventive importance in its own right, independently of the characteristics of Claims 1-3.

Despite the fact that, in the illustrated and thus preferred embodiment, the hip part (bar member 16F) carries out a motion to the raising lever by means of a cam arrangement 18A/18B during pivoting of raising lever 14′ and, that moreover, a buckling-compensation element 40 is inserted between bar members 16F and 16G, the outermost member of foot part 32B (bar member 16G) has a pivot joint 22 in the upper bar area at its area closest to adjacent bar member16F. This pivot joint 22 is formed in part by a pair of cams 36 of raising lever 14′ by virtue of the fact that these cams engage rotatably in corresponding recesses of bar member 16G. This arrangement has the effect that articulation point 22, 36* is raised in the pivoting upwards of

* [Part names are inconsistent in the German document.]

raising lever 14′. Because of the rotationally movable seating of pins 36 and the weight of the lower leg part, that is, that of the two parallel bar members 16G, the support elements 12 connecting them and a mattress possibly lying thereon, the outermost end (at the right in the drawing) of bar member 16G is always allowed to remain on its stationary base, such as long beam 30A. Under certain circumstances, however, there is a shift in the direction D along the support plane, such as long beam 30A.

In order to achieve a certain raising of bar member 16G as a whole in the upward pivoting of raising lever 14′, an extensible support member 20 in the form of a foot rest is provided. In the illustrated and thus preferred embodiment, the extensible bracing element is a knee lever with two legs 20A and 20B at a fixed angle to one another, which is seated with the ability to pivot about a shared pivot axis 20D in the knee area at the end and in the lower area of bar member 16G.

While bracing element 20 as a whole is housed in bar 16 in the extended position of the foot part according to Figure 2A, a pivoting about knee joint 20C causes an excursion of leg 20A downwards, so that bar member 16G raises the right end of bar member 16F in the drawing while the free end of leg 20A is braced against a base, such as long beam 30A. This raising is accomplished by active driving of leg 20A.

For this purpose, a rocker 50 is provided, with which angled section 14D′ of raising lever 14′ at one end and, at the other end, the free end of leg 20B of bracing element 20 are pivotably engaged. Rocker 50 is rotatably seated inside bar member 16F about pin 50C of rocker 50 [sic]. In the illustrated embodiment, this rocker 50 consists of a straight, extended metal rod made of flat material with elongated holes 50A and 50B at each end. Pivot pins 14E of raising lever 14 and 20D of bracing element 20 are in turn engaged in these elongated holes. When raising lever 14′ is raised and angled section 14D′ accordingly carries out a pivoting motion with respect to bar member16G about rotational joint 22, 36, rocker 50 is pivoted inside bar member 16F about its pivot pin 50C. This rocker movement, which is evident from the sequence of Figures 2A-2E [sic; 6A-6E], leads to a forced pivoting of bracing element 20, which is coupled to rocker 50, and thus to a driven excursion of the bracing element out of bar member 16G. When raising lever 14′ is lowered, bracing element 20 moves forcibly back into bar member 16G.

Any coupling of the bracing element to another component is thereby superfluous. Instead, a foot lever drive is created and integrated into bars 16. It is also not dependent on a permanent contact with a foundation or a base surface, but goes into action independently thereof. It is therefore possible, among other things, to move the foot part even beyond the maximal raising postion illustrated in Figure 6E, also by hand, for instance. It is also possible to carry out the excursion motion and/or to make the contact of bracing element 20 against a base only in a certain angular position or angular range of raising lever 14′.

A bar member chain according to the invention can, in principle, also consist only of one bar member for the head piece, one bar member for the middle part and one bar member for the foot part.

In an additional embodiment according to Figures 7A-8B, the same reference numbers are again used for identically acting components. This additional embodiment, which can also very favorably be employed in the context of the preceding embodiments, is distinguished in that rigid bar member 16E of middle part 32C comprises two electric motors 60A and 60B that are housed parallel to one another in bar member 16E and of which the output shafts 62A, 62B extend roughly parallel to bar member 16E. The outer electric motors 60A via, for example, an output, spindle a linearly guided carriage 63A, which entrains a link chain 64A acting on a tooth segment 14B, as is presented in detail in German Patent Application No. 102 31 290.7 of July 10, 2002, and represented by double-headed arrows in Figure 7A or in Figures 8A and 8B. The quarter-circular tooth segments 14B preferably used for this, which are rigidly joined to the torsion tube 14A or 14A', are arranged in the plane of the two raising levers 14 for the head part and are offset from the two raising levers 14' in the foot part, so that the moved bar members extend in a single vertical plane.

Of course, a synchronization of the pairwise-associated electric motors 60A and 60B in the facing bars is also possible by electrical or electronic means, but a forced coupling due to the connection to torsion tubes has proved to be particularly simple and effective.

List of reference symbols

A	Adjustment direction
D	Displacement direction
10	Adjusting device
12	Support element
12A	Support plane
14	Raising lever
14A	Torsion tube
14B	Tooth segment
14C	Bore
14D	Angled section
14D'	Angled section
14'	Raising lever
16	Bar
16'	Inside part
16''	Outside part

16A-16G	Bar members
18	Adjusting member
18A	Adjusting members on bars
18B	Adjusting members on raising lever
20	Foot rest (bracing element)
20A	Leg
20B	Leg
20C	Knee joint
20D	Pivot axis
20E	Cutout
22	Pivot joints
24	Drive device
26	Jamming protection means
28	Receptacle cutouts
30	Rigid bed frame
30A	Long beam
30B	Cross beam
32	Slat grating
32A	Head part
32B	Foot part
32C	Middle part
34	Spring strips/hoops
40	Buckling-compensation element
50	Rocker
50A	Elongated holes
50B	Elongated holes
50C	Pin
60A	Electric motor
60B	Electric motor
62A	Output shaft
62B	Output shaft
63A	Carriage
63B	Carriage
64A	Link chain
64B	Link chain